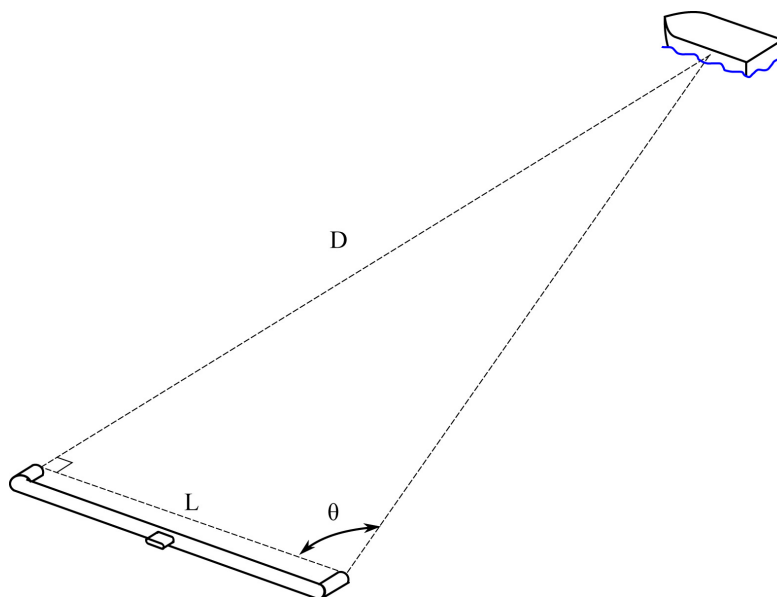


1.5: Measuring Distances

How do we measure to the distances to distant objects like stars? After, we cannot take an infinitely long tape measure out to these stars. So, we need an indirect method to measure these distances. For distance objects, use a method called triangulation. For example, if you want to measure the distance to a boat at sea, you start by marking a point on the shore directly in line with the ship. Then, you walk down the edge of the shore at a right angle to the imagine line between the boat and the point you marked. Next, you measure the distance (L) from your initial point and a second point along the shore. Finally, you measure the angle (θ) from your second point to the ship. Now, you have two angles and one side of a right triangle. With a little trigonometry, you can then calculate the distance (D) from your first point and the ship.

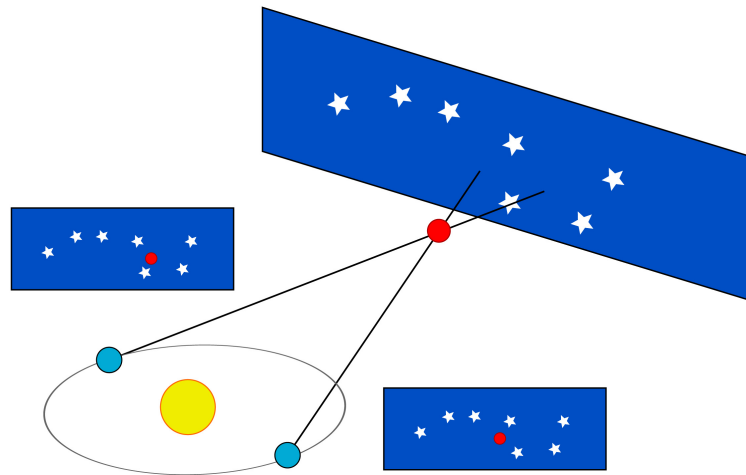


Measuring distances using triangulation.

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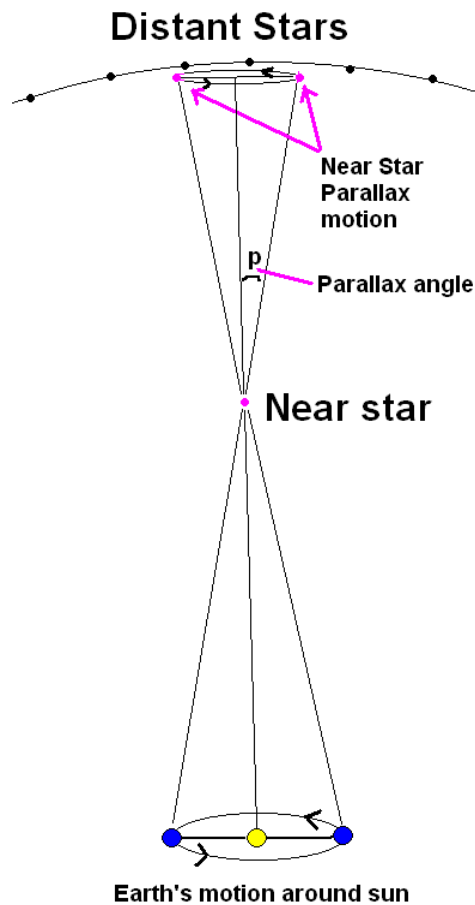
Techniques similar to this triangulation can be used to measure the distance to a star using a phenomenon called **parallax**, the apparent motion of objects against a more distant background. You can see a simple example of parallax by holding your thumb up against a distant object and closing one eye. Then, switch to the other eye. Your thumb will appear to change its position relative to the more distant object.



Positions of nearby stars appear to shift relative to the more distant stars as Earth revolves around the Sun.

"File:ParallaxV2.svg" by Kes47 (?) Original version from German Wikipedia. By user: WikiStefan. 28 Oct 2004 is licensed under CC BY 3.0;

Because stars are so far away, the parallax is very minute, usually a fraction of an arcsecond. These tiny deviations can be detected by taking very precise measurements of a star's position from different locations or different times of the year. In these case, we use the radius of the Earth or the radius of the Earth's orbit as the base of our triangle.



Using parallax to measure the distances to stars.

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